South Fork Coeur d'Alene River Sediment Subbasin Assessment and Total Maximum Daily Load

May 17, 2002

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the South Fork Coeur d'Alene Subbasin that have been placed on what is known as the "303(d) list" for sediment. The water bodies listed for metals were addressed in the Coeur d'Alene Basin Metals TMDL (DEQ-EPA 2000).

The overall purpose of this subbasin assessment and TMDL is to characterize and document sediment loads within the South Fork Coeur d'Alene Subbasin. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the South Fork Coeur d'Alene Subbasin (Chapter 5).

1.1 Introduction

In 1972, Congress passed public law 92-500, the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to

identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses. These requirements result in a list of impaired waters, called the "303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the 303(d) list. *South Fork Coeur d'Alene River Sediment Subbasin Assessment and Total Maximum Daily Load* provides this summary for the water bodies currently listed for sediment in the South Fork Coeur d'Alene River Subbasin.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the South Fork Coeur d'Alene Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR § 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation – primary (swimming), secondary (boating)
- Water supply – domestic, agricultural, industrial
- Wildlife habitats, aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The South Fork Coeur d'Alene River (South Fork) and its major tributaries (Willow, Canyon, Nine-mile, Placer, Lake, Two-mile, Big, Milo, Pine, and Bear Creeks) drains the entire subbasin (17010302)(Figure 1).

Climate

Northern Idaho is located in the Northern Rocky Mountain physiographic region to the west of the Bitterroot Range. The Coeur d'Alene and St. Joe Mountains, which the South Fork drains, are a part of the Bitterroot Range. Both Pacific maritime air masses from the west as well as continental air masses from Canada to the north influence local climate. The annual weather cycle generally consists of cool to warm summers with cold and wet winters. The relative warmth of summers or winters depends on the dominance of the warmer, wetter Pacific or cooler dryer continental air masses. Precipitation is greatest during the winter.

From 1961 to 1990, the average annual maximum temperature was 55.9^{o} F and the average annual minimum temperature was 33.2^{o} F at Wallace/Woodland Park (University of Idaho 1994). For the same time period, the month with the lowest average maximum (33.1^{o} F) and lowest average minimum (18.6^{o} F) temperature was January. July had the highest average annual minimum temperature (47.8^{o} F) recorded during the 1961 to 1990 time period. August had the highest average annual maximum temperature (80.6^{o} F) observed from 1961 to 1990.

Although intervening mountain ranges progressively dry the Pacific maritime air masses, these air masses deposit appreciable moisture primarily as snow on the South Fork watershed. Maritime air masses originating in the mid-Pacific are relatively warm, often yielding their precipitation as rain. Relief of the watershed is generally between 2,200 and 5,700 feet with 41.6% watershed in the rain on snow elevation range of 3,300 to 4,500 feet. Below 3,300 feet the snow pack is transitory, while above 4,500 feet the snow pack is sufficiently cool that warming by a maritime front is insufficient to cause a significant thaw. In the rain on snow elevation range (3,300 - 4,500 feet), a warm and heavy snow pack accumulates each winter. A warm maritime front can sufficiently warm the snow pack making it isothermal and capable of yielding large volumes of water to a runoff event.

Data from Wallace/Woodland Park shows that the 30-year average annual precipitation from 1931 to 1955 was reported at 35.43 inches (Dancer 1993). From 1961 to 1990 at Wallace/Woodland Park, the average annual precipitation was 39.24 inches. (University of Idaho 1994). January exhibited the largest amount of precipitation at 5.51 inches and July the lowest amount of precipitation at 1.29 inches.

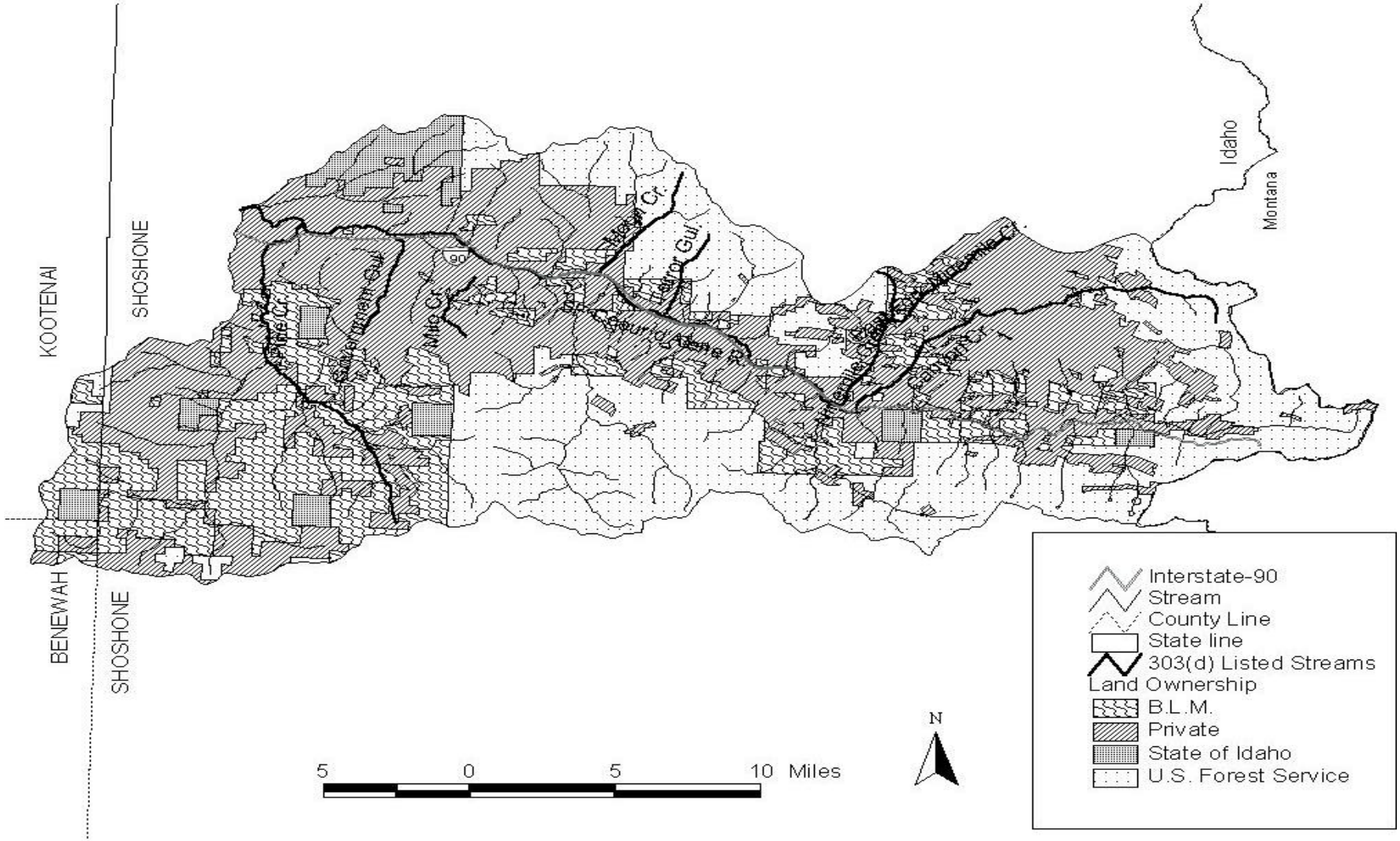

Figure 1. South Fork Coeur d'Alene Subbasin

Subbasin Characteristics

- Hydrology

The South Fork Coeur d'Alene River Subbasin and its tributaries flow from the Coeur d'Alene and St Joe Mountains to the river's confluence with the North Fork Coeur d'Alene River near Enaville, Idaho (Figure 1). The watershed above the North Fork confluence encompasses approximately 298 square miles (190,765 acres).

A weather station has operated intermittently at the Wallace Ranger Station, since 1931. The U.S. Geological Survey (USGS) has operated discharge gauging stations at Pinehurst since 1989, Elizabeth Park since 1987; Silverton, 1967-1987; and Placer Creek, since 1967. As part of the remedial investigation of mining wastes, USGS operated gages on Canyon Creek, Ninemile Creek, Moon Creek and Pine Creek near their mouths during water year 1999. The USGS continues to operate the gages at Pinehurst, Smelterville, Pine Creek, Elizabeth Park, and Ninemile Creek. It operates assorted gages in the East Fork Pine Creek watershed for the Bureau of Land Management (BLM)(Figure 2).

- Geology and soils

The South Fork drains the Coeur d'Alene and St. Joe Mountains, subsets of the Bitterroot Mountains. The mountains are composed in large part of meta-sedimentary rocks of the Proterozoic Belt Super-group. The bedrock is almost entirely from the Wallace, Prichard and Striped Peak formations. Granetic intrusions (Gem stocks) are found in a few areas. Landform is steepened but generally stable. Mass failures are not a typical feature of the landform development, but are specific to a few land types. These are typically glacial deposits located primarily in the valley bottoms. Valley bottoms are composed of colluvial deposits in the steep valleys and gulches. In the broader floodplains of the South Fork below Wallace and lower Canyon Creek, alluvial materials worked by these streams comprise the valley bottoms.

The mountain slopes are underlain by silty to silt loam podsolic soils developed under cool conditions. Volcanic ash deposits are variably found in the soil mantle. Soil mantle is generally thin on slopes with A and B horizons of three to four inches. Soil mantle generally decreases with altitude. Soils in the bottomlands may be silty to sandy podsols developed under upland forest. Near streams and in some pockets, black mucky soils exist where red cedar stands were the dominant vegetation.

- Topography

The Coeur d'Alene and St Joe Mountains are characterized by high and massive mountains and deep dissected intermountain valleys. Valleys range down to 2,200 feet while most mountains reach just over 5,000 feet. Peaks on the Bitterroot, Latour, and St. Joe Divides range to over 6,000 feet. Mountain slopes are generally greater than 40%. The tributary watersheds to the South Fork have slopes predominant with east and west aspects.

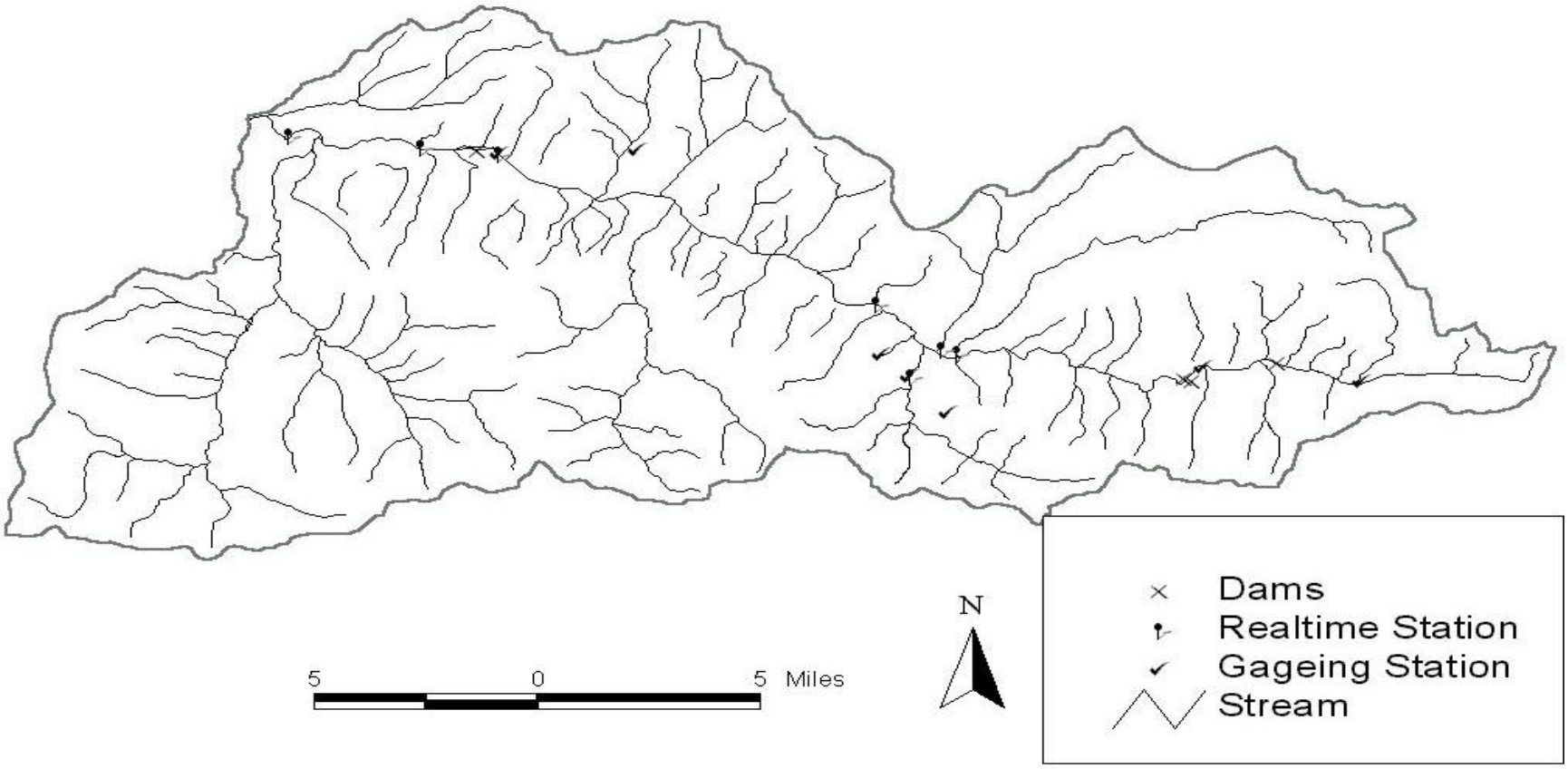

Figure 2. South Fork Coeur d'Alene Subbasin showing real time and stage stream gages.

The exceptions are Canyon, Placer, and Bear Creek that have a predominance of north and south facing aspects. The slopes immediate to the South Fork have a predominance of north and south aspects (Table 1).

- Vegetation

The mountain slopes are mantled with mixed coniferous forest of true fir, Douglas fir, larch, and pine. Rivers and streams are flanked by riparian stands dominated by cottonwood at lower elevations and alder in the higher valleys. Prior to settlement, riparian forests dominated by western red cedar and large cottonwood flanked the river and the lower reaches of its tributaries (Russell 1985). Red cedar boles that fell into the streams were an important source of large organic debris (LOD). The boles provided pool habitat and sediment storage. Logging of the riparian cedar stands and development of the settlements of Wallace, Osburn, and Kellogg removed these riparian stands. Remaining tracts of widened valley bottom where stream gradient are low along the South Fork and Canyon Creek were converted to tailings impoundment areas between 1900 and 1933. These riparian zones have not recovered because metals contaminants interfere with the availability of phosphate to vegetation.

- Fisheries and aquatic fauna

The native salmonids of the subbasin's streams are cutthroat trout, whitefish, and bull trout. Sculpin and shiners are non-salmonid natives. The tailed frog, giant salamander, and turtles completed the aquatic vertebrate species. The fish fauna of the river and some of its tributaries have been altered by the introduction of rainbow and brook trout as well as chinook salmon. Introduced species have been able to establish in some habitats at lower elevations, while higher elevation water bodies tend to retain the native cutthroat trout. Although fish composition appears stable in the headwaters, fish abundance is depleted from the historic levels by metals and sediment impacts (see Section 2.3). Young of the year salmonids are rarely found in the river below Wallace and the metals impaired tributaries below the mining impacts. Sculpins are rarely found below the mining impacts.

The subbasin was a part of the bull trout range (Maclay 1940). Since bull trout have not been reported in any of the extensive fish monitoring of the basin, the logical conclusion is that it has been functionally extirpated from the subbasin. No sensitive bull trout streams have been identified within the subbasin. No other threatened or endangered aquatic species are known in the subbasin.

Subwatershed Characteristics

The sub-watershed characteristics are summarized in Table 1.

Table 1. Characteristics of the fifth order watersheds of the South Fork Coeur d'Alene Subbasin.

Fifth Order watershed	Area (acres)	Land Form	Dominant Aspect	Relief Ratio[1]	Mean Elevation (m)	Dominant Slope	Hydrologic Regimes	Estimated Water Yield (acre-feet/year)	Mass Wasting Potential
Upper South Fork	32,613	mountainous	west	0.047	1,422	40%+	spring snowmelt	84,363	low
Canyon Creek	13,787	mountainous	west	0.061	1,501	40%+	spring snowmelt	35,664	low
Ninemile Creek	7,355	mountainous	west	0.094	1,311	40%+	spring snowmelt	19,026	low
Placer Creek	10,043	mountainous	east	0.081	1,332	40%+	spring snowmelt	25,979	low
Middle Gulches	18,519	mountainous	west	0.082	1,121	40%+	spring snowmelt; rain on snow	47,905	low
Terror Gulch	1,915	mountainous	south	0.120	1,078	40%+	spring snowmelt; rain on snow	4,954	low
Big Creek	21,377	mountainous	west	0.069	1,557	40%+	spring snowmelt	55,298	low
Moon Creek	5,743	mountainous	west	0.098	1,046	40%+	spring snowmelt; rain on snow	14,856	low
Montgomery Creek	4,914	mountainous	east	0.110	1,049	40%+	spring snowmelt; rain on snow	12,712	low
Lower Gulches	17,219	mountainous	north	0.081	985	40%+	spring snowmelt; rain on snow	44,542	low
East Fork Pine Creek	19,288	mountainous	west	0.082	1,227	40%+	spring snowmelt; rain on snow	49,894	low
Pine Creek Headwaters	18,237	mountainous	south	0.088	1,301	40%+	spring snowmelt; rain on snow	47,176	low
Pine Creek Sidewalls	13,330	mountainous	north	0.093	985	40%+	spring snowmelt; rain on snow	34,482	low
Bear Creek	7,218	mountainous	south	0.090	1,147	40%+	spring snowmelt; rain on snow	18,672	low

1. Relief ratio; $R_h = H/L$, where H is the difference between the highest and lowest point in the basin and L is the horizontal distance along the longest dimension of the basin parallel to the main stream line.

Stream Characteristics

Tributaries to the South Fork Coeur d'Alene River generally have V shaped valleys as a result of the deeply dissected nature of the topography. These valleys accommodate primarily Rosgen A and high gradient B channels. There are exceptions at Woodland Park Flats in lower Canyon Creek, a short section of Placer Creek, lower East Fork Pine Creek, and in the valley of Pine Creek below Langlois Creek. These broader valleys accommodate low gradient Rosgen B channels. The tributaries generally have boulder-bedrock control. Their channel morphology is typically Rosgen A and high gradient B channels. The Belt Supergroup bedrock of the subbasin weathers to soils rich in coarse fragments (60-75%) and rather poor in fine materials (25-40%). Silts dominate the fine soil materials. As a consequence of the soil composition and the steep tributary gradients, boulders and cobble comprise the majority of the stream sediment particles. Width to depth ratios are lower in these streams. The low gradient B channels of tributaries have cobble as the primary stream sediment particles. The width to depth ratio is higher. Floodplains are narrow in most tributary channels. Broader floodplains are found in the wider valleys noted above. Riparian communities correspondingly are narrow in the narrow valleys and broader where valleys and floodplains widen.

The South Fork above the town of Wallace is similar to the other tributary channels in valley shape, stream gradient, channel sediment, floodplain width and riparian communities. At Wallace, the South Fork is joined by Canyon, Ninemile, and Placer Creeks within the distance of a mile reach. The valley slopes remain steep, but the valley floor widens. The channel is a moderate to low gradient Rosgen B channel below Wallace. The channel passes through 'flats" at Osburn, Big Creek, and Smelterville. The channel is at its lowest gradient through these reaches. The "flats" reaches are isolated by "narrows" reaches, which are characterized by a higher gradient. Width to depth ratio is lower in the "narrow" reaches as compared to the "flats." Cobble particle sizes dominate the stream sediments, but a higher percentage of sand and finer materials are present. The "flats" have correspondingly wider floodplains and would naturally have more extensive riparian communities. The "narrows" areas have a narrower floodplain and would naturally have less extensive riparian communities.

1.3 Cultural Characteristics

The South Fork Coeur d'Alene River Subbasin contains silver, lead, and zinc deposits. Since the discovery of these deposits in the mid-1880s, the floodplains and streams of the South Fork have been subject to considerable and intensive development. The scope of the development is described in the following sections.

Land Use

Land use of the South Fork Subbasin is shown in Figure 3. The floodplain of the river and those of several tributaries have been developed for towns and small communities. These areas also support the transportation corridors and most of the ore milling capacity (Figure 4).

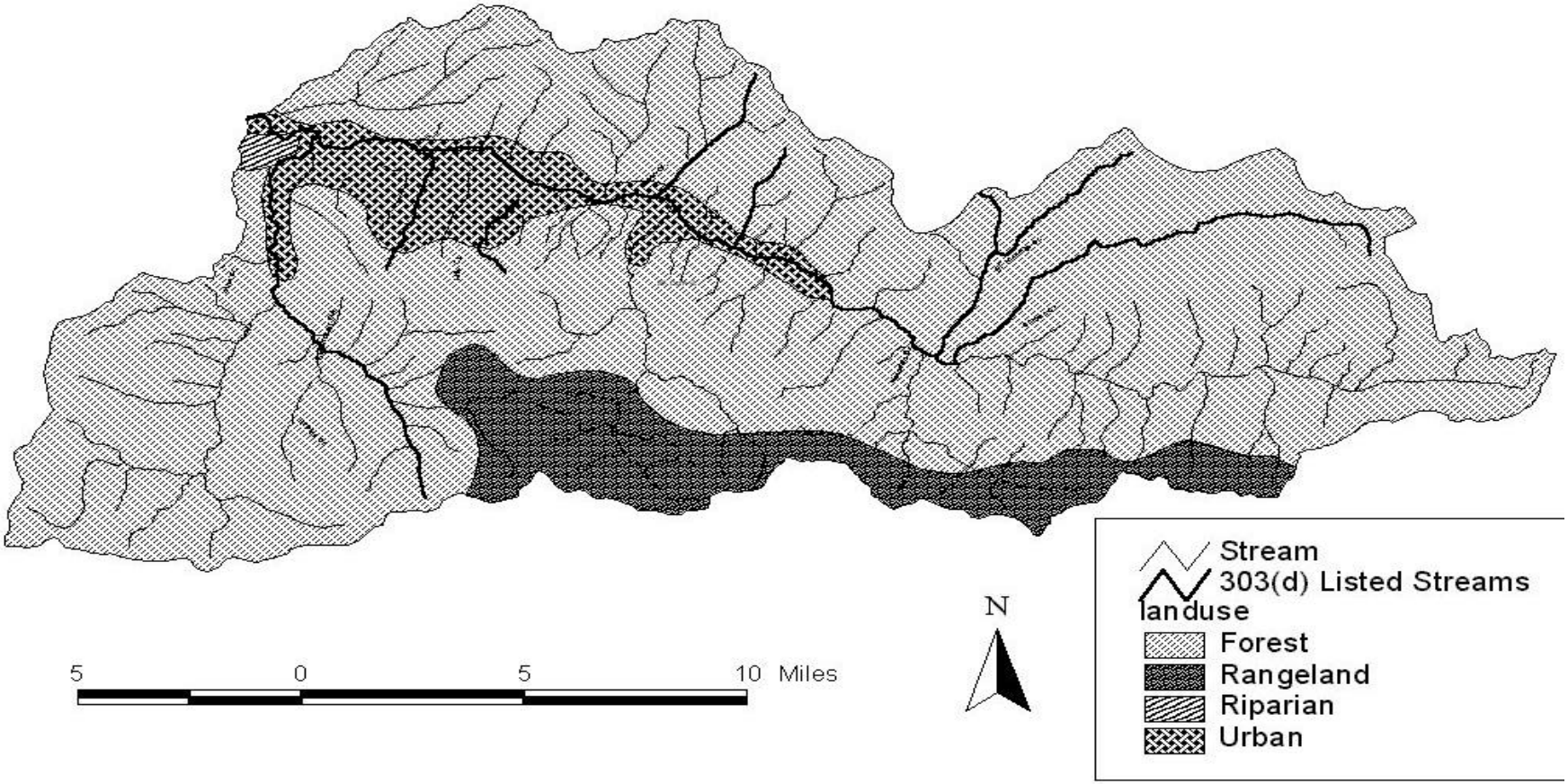

Figure 3. Land use of the South Fork Coeur d' Alene Subbasin

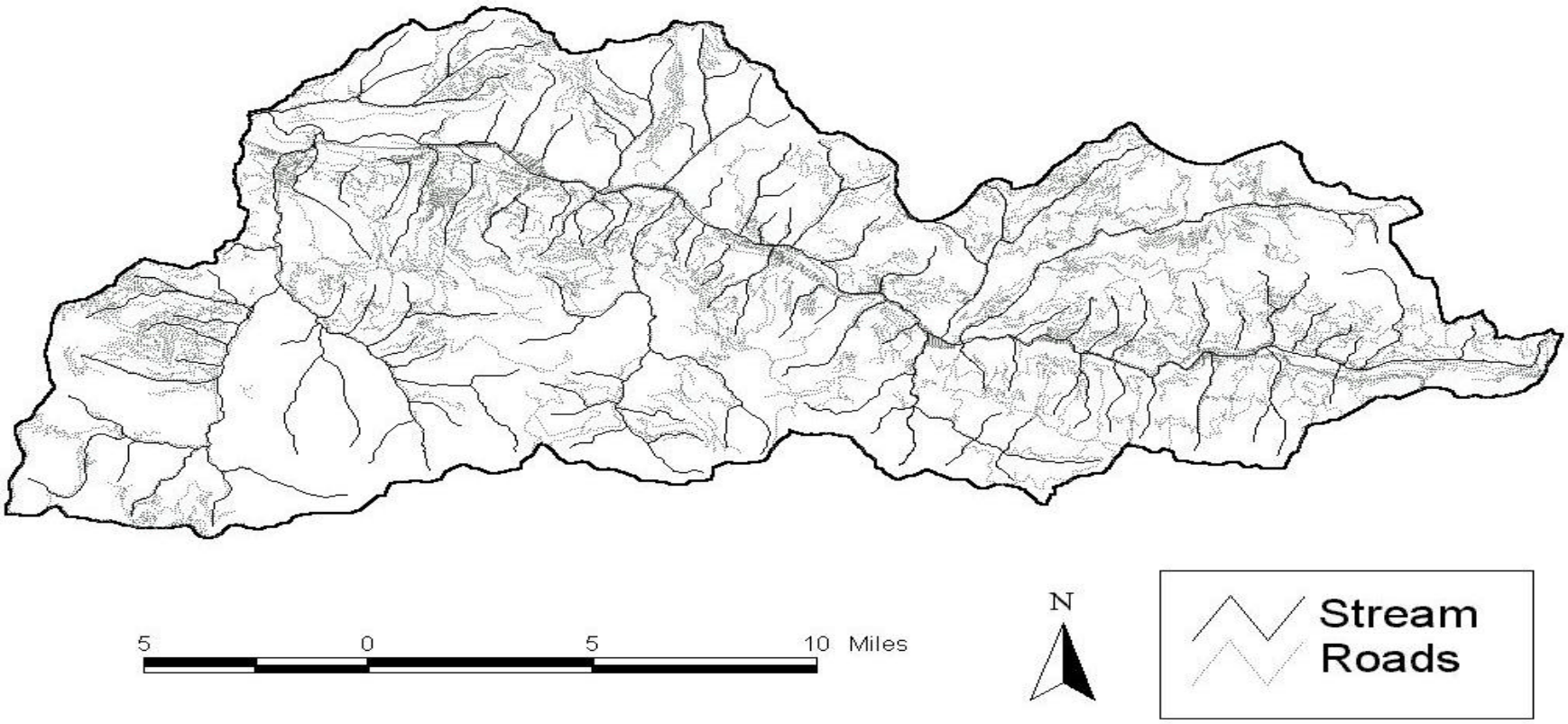

Figure 4. Roads and road crossings of streams of the South Fork Coeur d'Alene Subbasin

Land use is divided between the uplands and the valley bottoms. National forestlands are managed for multiple resource outputs (timber, water, and recreation). Commercial forestlands are managed primarily for timber production. Louisiana Pacific is the largest single commercial forest landowner. One recreation area (picnic and campgrounds) is located at Shoshone Park. One national recreational trail is located along the northern divide of the watershed. In recent years the Silver Valley has promoted winter and summer back road recreation on the forest roads of the watershed.

Mineral locations have been made and highly developed throughout the watershed in the past 120 years. Mineral development was relatively extensive in the Canyon, Ninemile, Lake, Moon, Big, Milo, and Pine Creek sub-watersheds. Mineral development has been intensive along the South Fork from Daisy Gulch to Pine Creek. Silver, lead, and zinc mines and mills are common. The largest mines and mills are listed in Table 2. The Coeur d'Alene Basin Metals TMDL addresses the metals exceedances caused by these sources (EPA-DEQ 2000). Waste rock and tailings piles from these mines or the constraints they place on adjacent streams are a source of sediment.

Much of the mining and/or milling capacity of the Silver Valley Mining District has declined since the 1980s. Mills and the smelter facility at Bunker Hill have been cleaned up under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) authorities or are slated for clean up. After removal of the hazardous materials, some of these sites are finding industrial or recreational uses.

Table 2. Major mines and mills of the South Fork Coeur d'Alene River Subbasin.

Upper SF	**Canyon**	**Ninemile**	**Lake**	**McFarren Gulch**	**Moon**	**Big**	**Milo-Bunker**	**Pine-EF Pine**
Snowline	Hercules	Interstate	Galena	Coeur	Silver Crescent	Sunshine	Sullivan	Constitution
Gold Hunter	Star	Rex		Argentine	Dickens		Bunker Hill	Douglas
Lucky Friday	Tiger-Poorman	Success (Granite)					Page	Highland Surprise
National	Hecla	Day Rock						Sydney
Morning	Standard-Mammoth	Black Cloud						Nevada Stewart
Golconda	Tamarack							Pittsburg
	Black Bear							Hilarity
	Federal							Denver
	Gem							Nabob
								Lynch
								Liberal King
								Amy
								Matchless

Land Ownership, Cultural Features, and Population

The majority of the Shoshone County population of 13,771 resides in the South Fork's watershed (Figure 1). The primary communities are Elizabeth Park, Kellogg, Mullan, Osburn, Pinehurst, Silverton, Smelterville, and Wallace. Significant populations live in the tributary valleys of Canyon, Ninemile, Twomile, Big, Moon, and Montgomery Creeks. Population is sparse in the remainder of the watershed. Population has declined in the subbasin as the mining industry has atrophied.

In the 190,675 acre watershed, management is divided into 84,685 acres of private land (44.4%), 62,369 acres Forest Service managed land (32.7%), 36,227 acres Bureau of Land Management managed land (19%), and 7,426 acres state managed land (3.9%)(IDL GIS database). Private properties are primarily bottomland along the lower South Fork or near the mouths of tributaries and on extensive mine lands (Figure 1).

History and Economics

The watershed has sustained appreciable development since the 1880's as the result of settlement and development driven economically by the mining industry. The towns of the valley and the "gulch communities" were developed in the narrow floodplains of the streams. Initially railroads, and later paved roads further, constrained the streams. Mills, tailings piles, and the smelting facility at Bunker Hill were located in the valley bottoms. The Interstate 90 corridor passes through the valley. In many locations it too constrains the streams. Most of the roads into the tributaries were built in the stream bottoms, fundamentally altering stream gradient and stability.

Timber harvest was restrained in the South Fork watershed during the mining era. Timber stands were young and not of merchantable size as result of the 1910 fire. Some harvest from mine lands occurred. More intensive timber harvest has occurred during the past decade. Mine land previously owned by Hecla Mining Company and Bunker Limited Partnership have been purchased and harvested by Louisiana Pacific and other smaller timber companies. The watershed has approximately, 18**%** of its area harvested at least one time (IPNF Stands and IDL GIS database), most of this by seed tree or shelter wood harvest methods. Agriculture has never been a large land use in the South Fork watershed due to the thin rocky soils.

No dams or diversions of the South Fork Coeur d'Alene River or its tributaries currently exist. In earlier years, some diversions were made to mills in tributaries, but these are all abandoned. Several of the mining facilities retain National Point Discharge Elimination System (NPDES) permits (Table 3). Many of these permits are expired and will not be renewed. The Hecla Lucky Friday, Silver Valley Resources, and Sunshine permit are currently being renewed. The Mullan, Smelterville, and Page wastewater treatment facilities have NPDES permits. The renewal of these permits is in progress.

Table 3. South Fork Coeur d'Alene NPDES permits.

Source	**Permitted Discharges**
Lucky Friday	3
ASARCO (Coeur, Galena)	2
Consil	1
Sunshine	3
Bunker Hill	1
Star/Morning Mine	2
Caladay	1
Silver Baron (inactive)	1
SF Coeur d'Alene Sewer District	2
Smelterville	1

Several local groups have been involved in water quality issues in the subbasin. The Coeur d'Alene Basin Citizens' Advisory Committee (CAC) has provided input to DEQ and EPA for the past nine years. It has served as a watershed advisory group for earlier TMDLs. The CAC has representation of the Idaho Conservation League, Kootenai Environmental Alliance, Save Our River Environment, and The Lands Council. These are the major environmental interest groups in the area. The group also has representatives of the major industries (timber, agriculture, and mining) as well as citizens without affiliation. The newest interest group, the Shoshone Natural Resource Coalition, has been made a member of the CAC. All of these groups work individually on water quality issues in addition to their participation in the CAC.